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## Physicians' Counseling of Adolescents Regarding E-Cigarette Use


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### A B S T R A C T

**Purpose:** Electronic cigarette (e-cigarette) use now surpasses the use of conventional cigarettes among U.S. adolescents. Given the important role of physicians in preventing adolescent risk behaviors, we sought to understand how physicians communicate about e-cigarettes when counseling adolescent patients and their parents. We also explored physicians' support for regulations aimed at discouraging adolescents' e-cigarette use.

**Methods:** A national U.S. sample of 776 pediatricians and family medicine physicians who provide primary care to adolescent patients completed an online survey in Spring 2014.

**Results:** Many physicians (41%) would, if asked, tell their patients that e-cigarettes are less harmful than cigarettes, and a substantial minority (24%) would recommend e-cigarettes to adolescents for smoking cessation. Most physicians reported routinely screening adolescent patients for cigarette smoking but few routinely screened for e-cigarette use (86% vs. 14%;  $p < .001$ ). Routine counseling was similarly more common for avoiding cigarette smoking than for avoiding e-cigarette use (79% vs. 18%;  $p < .001$ ). Support for government regulation of e-cigarettes was high, with 91% of physicians endorsing policies that prevent minors from buying e-cigarettes.

**Conclusions:** Physicians infrequently screen or counsel their adolescent patients about e-cigarette use, although e-cigarettes often come up during visits. Additional efforts by physicians could help prevent future use by adolescents. Recommending e-cigarettes as a smoking cessation aid to adolescent patients is inadvisable given the lack of evidence for efficacy in that population. As federal regulation of e-cigarettes remains in limbo, pediatricians and family medicine physicians can offer a powerful voice for informing regulations aimed at reducing use by adolescents.

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### IMPLICATIONS AND CONTRIBUTION

More adolescents now use e-cigarettes than conventional cigarettes. In this national study, many fewer physicians screened or counseled their adolescent patients about use of e-cigarettes compared with cigarettes. Enhancing physicians' abilities and opportunities to screen and counsel about e-cigarette use could help prevent adolescents from engaging in this risky behavior.

Adolescents' use of electronic cigarettes (e-cigarettes) is a growing public health concern. E-cigarettes are battery-powered devices that heat a solution of e-liquid (typically containing humectants, flavorings, and nicotine) into an inhalable aerosol.

**Conflicts of Interest:** The authors have no conflicts of interest to disclose.

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Adolescents' use of e-cigarettes, which are also called vapes, vape pens, and mods, has increased dramatically since their introduction in the U.S. marketplace in 2007 [1–3]. E-cigarette use tripled among middle- and high-school students from 2013 to 2014, and more students reported using e-cigarettes in the past 30 days than conventional cigarettes [3]. E-cigarettes pose a risk to adolescent health for multiple reasons. E-cigarette use may act as a gateway to smoking conventional cigarettes [1], although studies have yet to conclusively demonstrate such a finding.

However, recent increases in rates of use of e-cigarettes by adolescents occurred simultaneously as decreases in rates of conventional cigarette smoking, allowing for the possibility that e-cigarettes could be a pathway from or substitute for tobacco smoking [3]. Nonetheless, most e-liquid and e-cigarette aerosol contain nicotine [4], which is addictive. Although research with adults suggests that e-cigarettes may be less addictive than cigarettes [5,6], no studies have examined the addictive potential of e-cigarettes among youth, who have heightened sensitivity to nicotine [7]. Exposure to nicotine can alter the structure and function of the developing brains of adolescents [8,9] and harm fetal development should adolescents be using e-cigarettes during pregnancy [10]. If ingested or spilled on the skin, e-liquid containing high concentrations of nicotine can be toxic [11]. Finally, e-cigarette aerosol contains harmful chemicals such as formaldehyde and acetaldehyde [12]. Thus, although e-cigarettes are likely less harmful than conventional tobacco cigarettes [13,14], their use is not completely safe [15]. Unfortunately, e-cigarettes are not currently subject to federal regulation, although the U.S. Food and Drug Administration (FDA) has proposed a set of regulations including a nationwide ban on sales to minors [16].

Health care providers are well positioned to intervene to prevent or reduce adolescents' use of e-cigarettes as they do with other adolescent risk behaviors [17]. Organizations such as the American Academy of Pediatrics (AAP) have guidelines on best practices for preventing and treating tobacco use [18]. The AAP's "Bright Futures" guidelines suggest using the five A's approach, adding a sixth A for younger patients: (1) anticipate (future use among younger patients); (2) ask (about current use); (3) advise (about the dangers); (4) assess (willingness to change); (5) assist (with cessation efforts); and (6) arrange (for follow-up to check on progress). Unfortunately, not all physicians include these components (e.g., more physicians "advise" than "assist"), and prevention efforts are particularly lacking for younger adolescents [19]. When implemented, primary care-based interventions for children and adolescents can be effective for preventing and treating adolescent tobacco use [20]. However, little is known about how providers incorporate the topic of novel tobacco products such as e-cigarettes into preventive care visits with adolescents. Prior studies suggest that health care providers regularly discuss e-cigarettes with adolescent and adult patients [21–23] and the frequency of patient inquiries is increasing [23], but most providers feel that they lack sufficient knowledge about the product and express interest in learning more [21,24]. To our knowledge, this is the first study to explore the topic among a national sample of physicians who treat adolescents. Our study aimed to explore physicians' perceptions of the health harms of e-cigarettes, beliefs about using e-cigarettes for smoking cessation, and their strategies for counseling adolescent patients about e-cigarettes. Finally, given that federal regulation of e-cigarettes is currently in flux, we also examined physicians' support for possible regulatory efforts.

## Methods

### Participants

We conducted an online survey of pediatricians and family physicians (the specialties responsible for most adolescent primary care) in Spring 2014. The survey focused on administration of adolescent vaccines but also included questions about beliefs and behaviors relevant to other preventive care services,

including prevention of tobacco and e-cigarette use. Respondents were members of an existing national panel of physicians that was initially constructed from American Medical Association lists and maintained by a survey research company. Physicians were eligible to participate if they resided in the United States, spoke English, specialized in pediatrics or family medicine, and provided routine primary care to young adolescent patients (ages 11–12 years).

The survey research company sent invitations via e-mail to 2,368 physician panel members with pediatric or family medicine specialties, and 1,022 physicians (43%) opened the invitations and visited the survey Web site. Of these, 776 (76%) were eligible and completed the survey. Data on the percentage of ineligible respondents are not available, but overall, 33% of physicians in the panel completed the survey. Respondents provided informed consent online and received up to \$45 for their participation. The Institutional Review Board at the University of North Carolina approved the study protocol.

### Measures

Respondents first viewed images and a brief description of e-cigarettes. If they reported ever having talked about e-cigarettes during an adolescent visit, the survey assessed who typically raised the topic (the adolescent, the parent, the physician, or someone else) and the topics discussed. The survey also assessed respondents' main concerns about e-cigarettes and which e-cigarette topics they would like to learn more about. For items on e-cigarette topics and concerns, the survey used closed-ended response options including the potential health harms of using e-cigarettes, the potential health harms of breathing secondhand e-cigarette aerosol, whether using e-cigarettes helps smokers quit, and whether using e-cigarettes leads to smoking.

To understand attitudes about e-cigarettes as a possible tool for smoking cessation or harm reduction, we asked participants to indicate agreement (response scale ranged from "strongly disagree" [coded as 1] to "strongly agree" [coded as 5]) with these statements: "I would recommend adolescent smokers use e-cigarettes to quit smoking"; "I would recommend adult smokers use e-cigarettes to quit smoking"; and "If asked by adolescents or their parents, I would say that e-cigarettes are less harmful than regular cigarettes." In addition, participants indicated their agreement (same scale as aforementioned) with four possible regulations that would ban flavored e-cigarettes, ban advertisements targeting youth, prevent minors from purchasing, and prohibit e-cigarette use in places where smoking is not allowed. For the statement about willingness to recommend e-cigarettes to adolescents for smoking cessation and for the policy support variables, we recoded the variable such that a value of 0 indicated "strongly disagree," "somewhat disagree," or "neither disagree or agree," and 1 indicated "strongly agree" or "somewhat agree."

The survey assessed routine screening and counseling practices with the items "How often do you ask adolescents whether they [use e-cigarettes/smoke regular cigarettes]?" and "How often do you counsel nonsmoking adolescents about avoiding [e-cigarette use/smoking regular cigarettes]?" We dichotomized these variables such that a value of 0 indicated "never," "rarely," or "sometimes" and 1 indicated "often" or "always." We also combined the variables regarding screening and counseling to create a single, composite variable representing the physician's efforts at cigarette smoking prevention and e-cigarette use prevention. For

these variables, a value of 1 indicated that the physician “often” or “always” screened for use, counseled about use, or both. All other response combinations received a score of 0.

Finally, the survey included items assessing characteristics of the respondent (e.g., sex, clinical specialty) and their medical practice (e.g., number of adolescent patients seen per week). The survey also included a measure of the extent to which physicians follow guidelines for appropriate recommendation of human papillomavirus (HPV) vaccine. We chose this indicator because of its similarities with prevention efforts for tobacco smoking; both activities (counseling on tobacco and recommending HPV vaccine) are explicitly mentioned in existing practice guidelines, and both are intended to prevent cancer. We classified physicians who stated that they recommended HPV vaccine by age 12 years for both boys and girls as “following vaccine recommendations” (coded 1) and all other physicians as “not following vaccine recommendations” (coded 0).

To refine the survey items and ensure that physicians understood the wording as we intended, we conducted cognitive interviews with nine physicians. The survey company also pilot tested the survey with 60 physicians who were recruited in the same manner as the main sample.

### Analysis

We used McNemar’s chi-square analysis to compare the proportion of physicians who agreed that they would recommend e-cigarettes as a cessation tool to adults versus adolescents. We also used McNemar’s chi-square to compare the proportion of respondents who engaged in routine screening for cigarette smoking versus e-cigarette use and routine counseling for cigarette smoking versus e-cigarette use. Finally, we examined demographic, behavioral, and belief variables as potential correlates of three variables: willingness to recommend e-cigarettes to help adolescents quit smoking and the two composite measures of cigarette smoking prevention and e-cigarette use prevention (i.e., routinely screening, counseling, or both). We used bivariate logistic regressions and then included variables with statistically significant ( $p < .05$ ) bivariate relationships in a simultaneous multivariate logistic regression model. We conducted the analyses using Stata version 12 (StataCorp, College Station, TX). All statistical tests were two tailed with a critical alpha of .05.

### Results

Of the 776 participating physicians, 53% were pediatricians, and 47% were family medicine physicians (Table 1). Most physicians were male (68%), in private practice (85%), and worked in multiphysician practices (37% worked in practices with two to four physicians and 49% in practices with five or more physicians). About half had been in practice for at least 20 years (55%). Most physicians saw at least 10 adolescent patients per week (45% saw 10–24 patients, and 38% saw 25 or more).

#### E-cigarette attitudes and beliefs

**Concerns and need for information.** Physicians’ primary concern about e-cigarettes was most often the potential health harms of use (50%) and that using e-cigarettes may lead to smoking (35%; Figure 1). Many fewer physicians indicated that their primary concern was that e-cigarettes would not help smokers quit (7%), breathing secondhand aerosol might be harmful (5%), or they had

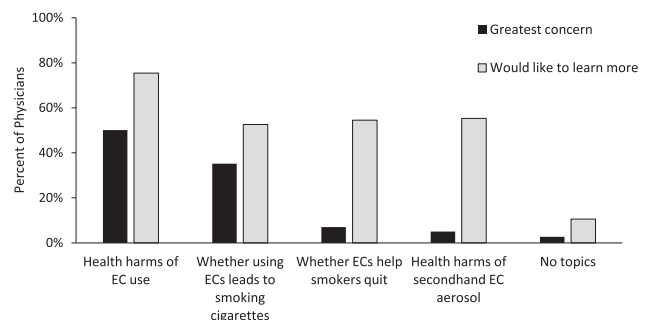
**Table 1**  
Sample characteristics (n = 776 physicians)

Characteristics	n	%
<b>Physician</b>		
<b>Sex</b>		
Male	526	67.8
Female	250	32.2
<b>Specialty</b>		
Pediatrics	410	52.8
Family medicine	366	47.2
<b>Years in practice</b>		
<10 years	61	7.9
10–19 years	291	37.5
20 or more years	424	54.6
<b>Adolescent patients seen per week</b>		
<10	129	16.6
10–24	351	45.2
25 or more	296	38.1
<b>Ever discussed e-cigarettes during adolescent visit</b>		
No	515	66.4
Yes	261	33.6
<b>Follow HPV vaccination recommendations</b>		
No	311	40.1
Yes	465	59.9
<b>Practice</b>		
<b>Region</b>		
Northeast	184	23.7
Midwest	165	21.3
South	275	35.4
West	152	19.6
<b>Clinic type</b>		
Private practice	660	85.1
Other	116	15.0
<b>Physicians in practice</b>		
One physician (solo practice)	115	14.8
Two to four physicians	283	36.5
Five to nine physicians	217	28.0
10 or more physicians	161	20.8

HPV = human papillomavirus.

no concerns (3%). Most physicians (89%) wanted to learn more information about at least one e-cigarette topic. The most popular topic for desired education was the potential health harms of use (75%), followed by the potential health harms of secondhand aerosol (55%), whether e-cigarettes help smokers quit (55%), and whether using e-cigarettes leads to smoking (53%).

**Cessation and harm.** Many physicians (40%) agreed that, if asked, they would tell adults or adolescents that e-cigarettes are less harmful than cigarettes. A substantial minority of physicians



**Figure 1.** E-cigarette (EC) topics about which physicians had concerns or wanted more information (n = 776).

agreed that they would recommend e-cigarettes for smoking cessation, although endorsement varied by patients' age (36% would recommend to adults vs. 24% would recommend to adolescents;  $p < .001$ ). In both bivariate and multivariate analyses, willingness to recommend e-cigarettes to adolescent patients was associated with beliefs about the harm of e-cigarettes and following vaccination recommendations. Physicians who agreed with the statement that e-cigarettes were less harmful than cigarettes were more likely to be willing to recommend them to adolescents for smoking cessation (35% vs. 17%; adjusted odds ratio [OR], 2.63; 95% confidence interval [CI], 1.88–3.70). Physicians who followed guidelines for vaccination were less likely to be willing to recommend (21% vs. 30%; adjusted OR, .68; 95% CI, .48–.96). No other variables were associated with willingness to recommend e-cigarettes to adolescents for quitting smoking.

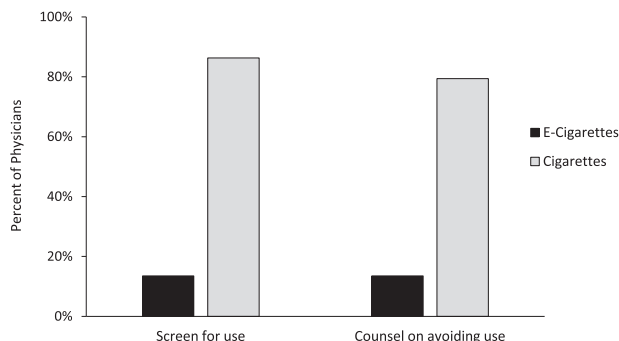
### E-cigarettes in the clinical encounter

**Discussion of e-cigarettes.** One third of physicians (34%) reported having ever discussed e-cigarettes during an adolescent's visit. Of those, the physician was the most likely to initiate the conversation (46%), followed by the parent (30%), the adolescent (23%), or someone else (2%). The most frequent topics of conversation were the potential health harms of using e-cigarettes (77%) and not starting to use e-cigarettes (65%). Fewer physicians reported discussing whether e-cigarette use helps smokers quit (49%), whether using e-cigarettes leads to smoking (42%), the potential health harms of breathing secondhand aerosol (41%), or other topics (5%).

**Screening and counseling.** Many fewer physicians routinely screened for e-cigarette use than cigarette smoking (14% vs. 86% often or always screened;  $p < .001$ ; Figure 2). Routine counseling about avoiding e-cigarette use compared with cigarette smoking followed the same pattern (18% often or always counseled about e-cigarettes vs. 79% for cigarettes;  $p < .001$ ; Figure 2).

In bivariate analyses, e-cigarette use prevention efforts correlated with specialty and number of physicians in the practice, but only specialty retained statistical significance in the multivariate model (Table 2). Family medicine physicians had higher odds of engaging in prevention of e-cigarette use than pediatricians (26% vs. 18%; adjusted OR, 1.57; 95% CI, 1.10–2.25).

Cigarette smoking prevention efforts were associated with region, number of physicians in the practice, and following vaccination recommendations in bivariate analyses, but only region and following vaccination recommendations were statistically significant in the multivariate model (Table 3).



**Figure 2.** Physicians' screening and counseling practices related to cigarettes and e-cigarettes ( $n = 776$ ).

Physicians in the South had lower odds of engaging in prevention for cigarette smoking than those in the Northeast (87% vs. 95%; adjusted OR, .38; 95% CI, .18–.79), as were physicians in the West (88%; adjusted OR, .40; 95% CI, .18–.91). Physicians who followed national guidelines for HPV vaccination had higher odds of attempting to prevent cigarette smoking than those who did not (93% vs. 86%; adjusted OR, 2.12; 95% CI, 1.31–3.43).

### Support for regulation of e-cigarettes

Most physicians supported regulation of e-cigarettes. Most agreed that e-cigarette use should be prohibited where smoking is prohibited (81%) and supported laws banning flavors for e-cigarettes (68%). Nearly all respondents also agreed that laws should prevent minors from buying e-cigarettes (91%) and advertisements targeting youth should be banned (86%).

### Discussion

Pediatricians and family medicine physicians are concerned about the health effects of e-cigarettes, interested in learning more about the topic, and supportive of regulatory action to prevent e-cigarette use among youth. Physicians are also initiating and engaging in discussions about e-cigarettes with their adolescent patients and their families. However, vastly fewer physicians routinely screen and counsel for e-cigarette use than those for cigarette smoking, which may reflect the novelty of the problem, the lack of practice guidelines, or the belief that e-cigarettes are less harmful than conventional cigarettes. Although e-cigarette aerosol contains fewer carcinogens and harmful constituents than cigarette smoke [25], the product is too new to understand whether exposure is linked to long-term, serious health consequences. Moreover, e-cigarettes can expose both users [4] and nonusers [26] to nicotine, a chemical that impacts adolescent brain development [8,9] and can be toxic at very high concentrations like those present in vials of e-liquid [11]. Thus, regardless of the comparative harm of e-cigarettes versus cigarettes, routine screening and counseling for e-cigarettes may benefit pediatric patients, particularly in light of increasing use among adolescents [1–3].

Family medicine physicians were more likely than pediatricians to try to prevent patients from using e-cigarettes. This finding is in line with the results of our previous study of providers who treat adolescent patients. In that study, family medicine physicians were more likely to be aware of e-cigarettes and reported greater perceived knowledge of and comfort discussing e-cigarettes than pediatricians or nurse practitioners [21]. Unlike pediatricians, family medicine physicians treat adult patients, and many adults ask their providers about e-cigarettes [22,23]. Thus, family medicine physicians may be more aware of the health issues surrounding e-cigarette use and more likely to screen or counsel their adolescent patients as a result. In general, family medicine physicians and pediatricians do not engage in smoking cessation efforts with adolescent patients in the same way [19,27,28]. For example, compared with pediatricians, family medicine physicians are more likely to assess adolescents' motivation to quit smoking, provide quit resources, and screen for use of smokeless tobacco (another "alternative tobacco product" such as e-cigarettes) [27].

Physicians who followed practice guidelines relevant to one area of cancer prevention (i.e., HPV vaccination) were more likely to follow practice guidelines for another type of cancer

**Table 2**  
Correlates of e-cigarette use prevention (n = 776)

	Number who engage in e-cigarette use prevention/total number in category, n (%)	Bivariate, OR (95% CI)	Multivariate, OR (95% CI)
Overall	168/776 (21.7)		
Physician characteristics			
Sex			
Male (Ref)	122/526 (23.2)	1.00 (—)	
Female	46/250 (18.4)	.75 (.51–1.09)	
Specialty			
Pediatrics (Ref)	73/410 (17.8)	1.00 (—)	1.00 (—)
Family medicine	95/366 (26.0)	1.62 (1.15–2.28)**	1.57 (1.10–2.25)*
Years in practice			
<10 years (Ref)	14/61 (23.0)	1.00 (—)	
10–19 years	55/291 (18.9)	.78 (.40–1.52)	
20 or more years	99/424 (23.4)	1.02 (.54–1.94)	
Adolescent patients seen per week			
<10 patients (Ref)	25/129 (19.4)	1.00 (—)	
10–24 patients	74/351 (21.1)	1.11 (.67–1.84)	
25 or more patients	69/296 (23.3)	1.26 (.76–2.11)	
Following vaccine recommendations			
No (Ref)	60/311 (19.3)	1.00 (—)	
Yes	108/465 (23.2)	1.27 (.89–1.80)	
Believe e-cigarettes are less harmful than cigarettes			
No (Ref) <sup>a</sup>	105/462 (22.7)	1.00 (—)	
Yes <sup>b</sup>	63/314 (20.1)	.85 (.60–1.21)	
Would recommend e-cigarettes to adolescents for quitting smoking			
No (Ref) <sup>a</sup>	127/588 (21.6)	1.00 (—)	
Yes <sup>b</sup>	41/188 (21.8)	1.01 (.68–1.51)	
Practice characteristics			
Region			
Northeast (Ref)	39/184 (21.2)	1.00 (—)	
Midwest	44/165 (26.7)	1.35 (.82–2.22)	
South	52/275 (18.9)	.87 (.54–1.38)	
West	33/152 (21.7)	1.03 (.61–1.74)	
Clinic type			
Private practice (Ref)	138/660 (20.9)	1.00 (—)	
Other	30/116 (25.9)	1.32 (.84–2.08)	
Physicians in practice			
One physician (solo practice; Ref)	33/115 (28.7)	1.00 (—)	1.00 (—)
Two to four physicians	54/283 (19.1)	.59 (.35–.97)*	.63 (.38, 1.04)
Five to nine physicians	36/217 (16.6)	.49 (.29–.85)*	.58 (.33–1.02)
10 or more physicians	45/161 (28.0)	.96 (.57–1.64)	1.11 (.64–1.91)

Multivariate model contains all correlates significant ( $p < .05$ ) in bivariate models.

CI = confidence interval; OR = odds ratio; Ref = reference category.

<sup>a</sup> “No” represents “strongly disagree,” “somewhat disagree,” or “neither disagree or agree.”

<sup>b</sup> “Yes” represents “strongly agree” or “somewhat agree.”

\* $p < .05$ ; \*\* $p < .01$ .

prevention (i.e., cigarette smoking). In contrast, following vaccination guidelines was not related to delivery of e-cigarette use prevention efforts, perhaps, because such efforts have yet to be codified in guidelines including Bright Futures [18]. This finding suggests that, should e-cigarettes be incorporated into practice guidelines in the future as conventional cigarettes currently are, more physicians might screen or counsel for adolescents' use.

Despite lower rates of screening and counseling than for conventional cigarettes, e-cigarettes are already part of physicians' clinical encounters with adolescents, as they are with adults [22,23]. One third of respondents in this study reported discussing e-cigarettes with adolescent patients, but the data suggest that e-cigarettes come up in conversation more frequently than that less than half of physician respondents said they “never” asked about (38%) or “never” counseled on avoiding (39%) e-cigarettes. Thus, our results might underestimate the prevalence of talking about e-cigarettes if physicians interpreted the item about “discussion” to mean only in-depth discussion.

Unfortunately, such discussions might include physicians' recommending e-cigarettes to adolescents for smoking cessation. Although some promising evidence suggests that e-cigarettes may aid cessation for adults [29] and a substantial minority of health care providers are recommending e-cigarettes to adult patients for this purpose [22,23], adolescents respond differently to smoking cessation interventions than do adults [30], and no randomized controlled trials have tested whether e-cigarettes help adolescents quit smoking. Physicians who followed vaccination guidelines were less likely to say that they would recommend e-cigarettes to adolescents as a tool for smoking cessation, perhaps, because they were more aware that the data on the utility of e-cigarettes for smoking cessation are inconsistent and the FDA has not approved them as a cessation aid. In a random sample of physicians in North Carolina in 2013, more than 10% mistakenly believed that the FDA had already approved e-cigarettes for smoking cessation [22]; this belief might have influenced the almost one quarter of physicians who would

**Table 3**  
Correlates of cigarette smoking prevention (n = 776)

	Number who engage in cigarette smoking prevention/total number in category, n (%)	Bivariate, OR (95% CI)	Multivariate, OR (95% CI)
Overall	699/776 (90.1)		
Physician characteristics			
Sex			
Male (Ref)	471/526 (89.5)	1.00 (—)	
Female	228/250 (91.2)	1.21 (.72–2.03)	
Specialty			
Pediatrics (Ref)	366/410 (89.3)	1.00 (—)	
Family medicine	333/366 (91.0)	1.21 (.75–1.95)	
Years in practice			
<10 years (Ref)	55/61 (90.2)	1.00 (—)	
10–19 years	256/291 (88.0)	.80 (.32–1.99)	
20 or more years	388/424 (91.5)	1.18 (.47–2.92)	
Adolescent patients seen per week			
<10 patients (Ref)	115/129 (89.2)	1.00 (—)	
10–24 patients	315/351 (89.7)	1.07 (.55–2.05)	
25 or more patients	269/296 (90.9)	1.21 (.61–2.40)	
Follow HPV vaccination recommendations			
No (Ref)	268/311 (86.2)	1.00 (—)	1.00 (—)
Yes	431/465 (92.7)	2.03 (1.26–3.27)**	2.12 (1.31–3.43)**
Believe e-cigarettes are less harmful than cigarettes			
No (Ref) <sup>a</sup>	420/462 (90.9)	1.00 (—)	
Yes <sup>b</sup>	279/314 (88.9)	.80 (.50–1.28)	
Would recommend e-cigarettes to adolescents for quitting smoking			
No (Ref) <sup>a</sup>	527/588 (89.6)	1.00 (—)	
Yes <sup>b</sup>	172/188 (91.5)	1.24 (.70–2.22)	
Practice characteristics			
Region			
Northeast (Ref)	174/184 (94.6)	1.00 (—)	1.00 (—)
Midwest	151/165 (91.5)	.62 (.27–1.44)	.58 (.25–1.36)
South	240/275 (87.3)	.39 (.19–.82)*	.38 (.18–.79)*
West	134/152 (88.2)	.43 (.19–.96)*	.40 (.18–.91)*
Clinic type			
Private practice (Ref)	592/660 (89.7)	1.00 (—)	
Other	107/116 (92.2)	1.37 (.66–2.82)	
Physicians in practice			
One physician (solo practice; Ref)	98/115 (85.2)	1.00 (—)	1.00 (—)
Two to four physicians	260/283 (91.9)	1.96 (1.00–3.83)*	1.95 (.99–3.84)
Five to nine physicians	196/217 (90.3)	1.62 (.82–3.21)	1.61 (.80–3.23)
10 or more physicians	145/161 (90.1)	1.57 (.76–3.26)	1.53 (.73–3.23)

Multivariate model contains all correlates significant ( $p < .05$ ) in bivariate models.

CI = confidence interval; OR = odds ratio; Ref = reference category.

<sup>a</sup> “No” represents “strongly disagree,” “somewhat disagree,” or “neither disagree or agree.”

<sup>b</sup> “Yes” represents “strongly agree” or “somewhat agree.”

\* $p < .05$ ; \*\* $p < .01$ .

recommend them to adolescent patients trying to quit smoking. Some physicians who would recommend e-cigarettes to adolescents trying to quit smoking might also be aware nicotine replacement therapies are not as helpful for youth as they are for adults [30]. Physicians who were aware of this finding or had previously experienced the failure of nicotine replacement therapies to help their adolescent patients may have been eager to find other, newly available options.

Physicians in this study were largely supportive of possible regulations that could limit youth access to and the appeal of e-cigarettes. Physicians who are especially concerned may be interested in advocating for their views. The field of pediatrics has a long history of advocacy [31]. For example, the AAP played a critical role in the passage of the State Child Health Insurance Plan, a program that resulted in health care coverage for millions of children and adolescents [31]. Previous advocacy strategies used by interested physicians include writing letters to the

editors of journals of newspapers, joining coalitions of community members, and drafting issue briefs for lawmakers.

Most family medicine physicians and pediatricians in our study were interested in learning more about e-cigarettes. There are some physician-specific resources on this topic, such as an AAP handout [32], but they are limited in scope. Designing appropriate educational materials is challenging given that the science surrounding e-cigarettes is evolving so rapidly. However, certain established, basic information about e-cigarettes would be useful to clinicians who treat adolescents. For example, given physicians' specific interest in learning more about health effects, materials should describe the effects of possible nicotine exposure from e-cigarettes and the presence of harmful chemical constituents in some samples of e-liquid and aerosol. This type of education may help discourage physicians from recommending e-cigarettes, an unproven cessation tool among youth, to adolescents for quitting smoking.

Limitations to this study include not surveying nurse practitioners or physician assistants who provide primary care to adolescents and not asking about physicians' prior clinical experiences with e-cigarettes (e.g., whether they had patients who used e-cigarettes to quit smoking or who experienced harm from e-cigarettes). In addition, our definition and images of e-cigarettes presented at the beginning of the study better represented older models of e-cigarettes than newer models (e.g., tank systems, mods). Use of the American Medical Association master list for recruitment may have limited our sample as not all physicians on that list have an e-mail address on record. Although the response rate was relatively low for a physician sample, this study was the first to capture a national sample of health care providers who treat pediatric patients.

Ultimately, understanding what health care providers believe and how they interact with patients about e-cigarettes is important because providers play a critical role in preventing adolescent risk behaviors including tobacco use [17]. Indeed, even brief counseling from clinicians can reduce adolescents' risky behaviors [33]. The results of the present study suggest a need to improve routine screening and counseling for e-cigarette use among adolescents and provide educational resources to physicians. Incorporating e-cigarettes into existing practice guidelines about tobacco use could boost prevention efforts and possibly prevent recommendation of e-cigarettes as smoking cessation tools for adolescents until there is conclusive evidence among youth. Because family medicine physicians and pediatricians play a key role in reducing adolescent risk behavior, their efforts, either through clinical practice or expressing support for regulation, are crucial for preventing further increases in e-cigarette use among youth.

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